IN THE CLAIMS

Please amend claims 15-17, 55 to 57, and 84 as follows.

Please cancel claim 133 without prejudice.

1. (previously presented) A method for etching a sample comprising a silicon material, the method comprising:

providing a vapor phase etchant to the silicon material, wherein the etchant comprises an interhalogen or a noble gas halide; and

etching the silicon material at a rate of 25 um/hr or less.

2. (original) The method of claim 1, wherein the silicon is etched at a rate of 7.2 um/hr or less.

3. (original) The method of claim 2, wherein the silicon is etched at a rate of about 3 um/hr or less.

4. (original) The method of claim 1, wherein the silicon is amorphous silicon having a hydrogen concentration of 40 at% or less.

5. (original) The method of claim 1, wherein the silicon is PECVD amorphous silicon deposited in a glow discharge.

6. (original) The method of claim 1, wherein the etching of the silicon material is at a pressure of from 0.5 to 760 Torr.

7. (original) The method of claim 6, wherein the etching of the silicon material is at a pressure of from 50 to 600 Torr.

8. (original) The method of claim 1, wherein the selectivity toward a material other than silicon is 2000:1 or more.

9. (original) The method of claim 2, wherein the selectivity toward a material other than silicon is 10000:1 or more.

10. (original) The method of claim 1, wherein the silicon is preferentially etched relative to a material other than silicon.

11. (original) The method of claim 10, wherein the material other than silicon is a silicon compound.

12. (original) The method of claim 11, wherein the silicon compound is silicon nitride or silicon dioxide.

13. (original) The method of claim 11, wherein the material other than silicon is a ceramic material.

14. (original) The method of claim 13, wherein the ceramic material is a nitride or oxide of a transition metal.

15. (currently amended) The method of claim 6, wherein the silicon comprises a dopant that is selected from PH3, P2H5, B2H5 and BCl3.

16. (currently amended) The method of claim 6, wherein the silicon comprises a dopant that is added by ion implantation of the silicon.

17. (currently amended) The method of claim 6, wherein the silicon comprises a dopant that is added during deposition of the silicon.

18. (original) The method of claim 4, wherein the silicon is PECVD, LPCVD or sputtered silicon.

19. (original) The method of claim 1, wherein the silicon has a long range order of 100 nm or less.

20. (original) The method of claim 16, wherein the ion implantation is performed at a 5 to 10 degree tilt angle of the substrate having the silicon thereon relative to the direction of the beams

of ions.

21. (original) The method of claim 1, wherein prior to etching the silicon material:
depositing the silicon material on a substrate; and
depositing a layer other than silicon on the silicon material.

22. (original) The method of claim 21, wherein a micromechanical device is formed after etching the silicon.

23. (original) The method of claim 22, wherein a micromirror array is formed.

24. (original) The method of claim 21, wherein the layer other than silicon is a silicon compound.

25. (original) The method of claim 21, wherein the layer other than silicon is a metal or metal alloy.

26. (original) The method of claim 21, wherein a plurality of layers other than silicon are deposited on the silicon material.

27. (original) The method of claim 1, wherein the silicon is polysilicon.

28. (original) The method of claim 1, wherein the vapor phase etchant is provided to a chamber in which the sample comprising silicon is disposed, and wherein the vapor phase etchant is capable of etching the sample in a non-energized state, and further comprising:
monitoring the gas in or from the etching chamber; and
determining the end point of the etch based on the monitoring of the gas from the etching chamber.

29. (original) The method of claim 28, wherein an end point is determined based on a value of an etching product passing below a threshold.

30. (original) The method of claim 28, wherein a derivative is taken of partial pressure values of an etching product.

31. (original) The method of claim 30, wherein an end point is determined when a derivative value is negative.

32. (original) The method of claim 28, wherein an end point is determined when a partial pressure of a gas component decreases for a predetermined period of time.

33. (original) The method of claim 28, wherein curve smoothing is performed prior to determining an end point of the etch.

34. (original) The method of claim 28, wherein the material is silicon and the etchant is a gas fluoride etchant.

35. (original) The method of claim 34, wherein the etch product that is monitored is a silicon fluoride compound.

36. (original) The method of claim 35, wherein the etch product that is monitored is SiF, SiF2, SiF3 and/or SiF4.

37. (original) The method of claim 1, wherein the silicon is doped during or after deposition.

38. (original) The method of claim 37, wherein the silicon is doped with boron, phosphorous or arsenic.

39. (original) The method of claim 38, wherein the doping is achieved by implantation at 10^{10} to 10^{14} ions/cm^3.

40. (original) The method of claim 39, wherein the doping is performed at an energy of 10 to 70 keV.

41. (previously presented) A method for etching a sample comprising a silicon material,

comprising providing a vapor phase etchant to the silicon material at a pressure of from .5 to 760 Torr, wherein the etchant comprises an interhalogen or a noble gas halide; and etching the silicon material at a rate of 20 um/hr or less.

42. (original) The method of claim 41, wherein the silicon is etched at a rate of 7.2 um/hr or less.

43. (original) The method of claim 42, wherein the silicon is etched at a rate of about 3 um/hr or less.

44. (original) The method of claim 41, wherein the silicon is a-Si.

45. (original) The method of claim 44, wherein the silicon is PECVD a-Si.

46. (original) The method of claim 41, wherein the etching of the silicon material is at a pressure of from 100 to 500 Torr.

47. (original) The method of claim 41, wherein the etching of the silicon material is at a pressure of from 50 to 600 Torr.

48. (original) The method of claim 41, wherein the selectivity toward a material other than silicon is 2000:1 or more.

49. (original) The method of claim 42, wherein the selectivity toward a material other than silicon is 10000:1 or more.

50. (original) The method of claim 41, wherein the silicon is preferentially etched relative to a material other than silicon.

51. (original) The method of claim 50, wherein the material other than silicon is a silicon compound.

52. (original) The method of claim 51, wherein the silicon compound is silicon nitride or

silicon dioxide.

53. (original) The method of claim 51, wherein the material other than silicon is a ceramic material.

54. (original) The method of claim 53, wherein the ceramic material is a nitride or oxide of a transition metal.

55. (currently amended) The method of claim 46, wherein the silicon comprises a dopant that is selected from PH3, P2H5, B2H5 and BCl3.

56. (currently amended) The method of claim 46, wherein the silicon comprises a dopant that is added by ion implantation of the silicon.

57. (currently amended) The method of claim 46, wherein the silicon comprises a dopant that is added during deposition of the silicon.

58. (original) The method of claim 44, wherein the silicon is PECVD, LPCVD or sputtered silicon.

59. (original) The method of claim 41, wherein the silicon has a long range order of 100 nm or less.

60. (original) The method of claim 56, wherein the ion implantation is performed at a 5 to 10 degree tilt angle of the substrate having the silicon thereon relative to the direction of the beams of ions.

61. (original) The method of claim 41, wherein prior to etching the silicon material:
depositing the silicon material on a substrate; and
depositing a layer other than silicon on the silicon material.

62. (original) The method of claim 61, wherein a micromechanical device is formed after etching the silicon.

63. (original) The method of claim 62, wherein a micromirror array is formed.

64. (original) The method of claim 61, wherein the layer other than silicon is a silicon compound.

65. (original) The method of claim 61, wherein the layer other than silicon is a metal or metal alloy.

66. (original) The method of claim 61, wherein a plurality of layers other than silicon are deposited on the silicon material.

67. (original) The method of claim 41, wherein the silicon is polysilicon.

68. (original) The method of claim 41, wherein the vapor phase etchant is provided to a chamber in which the sample comprising silicon is disposed, and wherein the vapor phase etchant is capable of etching the sample in a non-energized state, and further comprising:

monitoring the gas in or from the etching chamber; and

determining the end point of the etch based on the monitoring of the gas from the etching chamber.

69. (original) The method of claim 68, wherein an end point is determined based on a value of an etching product passing below a threshold.

70. (original) The method of claim 68, wherein a derivative is taken of partial pressure values of an etching product.

71. (original) The method of claim 70, wherein an end point is determined when a derivative value is negative.

72. (original) The method of claim 68, wherein an end point is determined when a partial pressure of a gas component decreases for a predetermined period of time.

73. (original) The method of claim 68, wherein curve smoothing is performed prior to determining an end point of the etch.

74. (original) The method of claim 68, wherein the material is silicon and the etchant is a gas fluoride etchant.

75. (original) The method of claim 74, wherein the etch product that is monitored is a silicon fluoride compound.

76. (original) The method of claim 75, wherein the etch product that is monitored is SiF, SiF2, SiF3 and/or SiF4.

77. (original) The method of claim 41, wherein the silicon is doped during or after deposition.

78. (original) The method of claim 77, wherein the silicon is doped with boron, phosphorous or arsenic.

79. (original) The method of claim 78, wherein the doping is achieved by implantation at 10^{10} to 10^{18} ions/cm^3.

80. (original) The method of claim 79, wherein the doping is performed at an energy of 10 to 70 keV.

81. (original) The method of claim 79, wherein the implantation is at 10^{14}.

82. (original) The method of claim 80, wherein the doping is performed at an energy of 20 to 40 keV.

83. (original) The method of claim 41, wherein the silicon is etched at a rate of 15 um/hr or less.

84. (currently amended) The method of claim 41,the silicon material is part of a silicon portion that is etched relative to a non-silicon portion of the sample, said non-silicon portion

consisting of a member selected from the group consisting of a non-silicon metal, a compound of a non-silicon metal, and a silicon-containing compound in which silicon is bonded to a non-silicon element, by exposing both said silicon portion and said non-silicon portion to an etchant gas selected from the group consisting of noble gas fluorides and halogen fluorides, ~~the improvement in which~~ wherein said etchant gas is utilized in the form of a gas mixture in which said etchant gas is mixed with a non-etchant gaseous additive, the partial pressure of said etchant gas in said gas mixture being at least about 0.1 mbar, and the molar ratio of said non-etchant gaseous additive to said etchant gas being from about 1:1 to about 500:1, such that said gas mixture achieves substantially greater etching selectivity toward said silicon portion than would be achieved with said etchant gas alone.

85. (original) The method in accordance with claim 84 in which said non-etchant gaseous additive has a molar-averaged formula weight of less than about 25.

86. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive has a molar-averaged formula weight of from about 4 to about 25.

87. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive has a molar-averaged formula weight of from about 4 to about 20.

88. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive has a molar-averaged formula weight of from about 4 to about 10.

89. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive has a molar-averaged thermal conductivity at 300 K and atmospheric pressure of from about 10 mW/(m K) to about 200 mW/(m K).

90. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive has a molar-averaged thermal conductivity at 300 K and atmospheric pressure of from about 140 mW/(m K) to about 190 mW/(m K).

91. (original) A method in accordance with claim 84 in which said molar ratio is from about 10:1 to about 200:1.

92. (original) A method in accordance with claim 84 in which said molar ratio is from about 20:1 to about 150:1.

93. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive is a member selected from the group consisting of nitrogen, argon, helium, neon, and mixtures thereof.

94. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive is a member selected from the group consisting of helium, neon, mixtures of helium and neon, and mixtures of one or both of helium and neon with one or both of nitrogen and argon.

95. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive is a member selected from the group consisting of helium, a mixture of helium and nitrogen, and a mixture of helium and argon.

96. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive is a member selected from the group consisting of helium and a mixture of helium and nitrogen.

97. (original) A method in accordance with claim 84 in which said non-etchant gaseous additive is helium.

98. (original) A method in accordance with claim 84 in which said etchant gas is a noble gas fluoride.

99. (original) A method in accordance with claim 98 in which said noble gas fluoride is a member selected from the group consisting of krypton difluoride and the xenon fluorides.

100. (original) A method in accordance with claim 98 in which said noble gas fluoride is a member selected from the group consisting of xenon difluoride, xenon tetrafluoride, and xenon hexafluoride.

101. (original) A method in accordance with claim 98 in which said noble gas fluoride is xenon difluoride.

102. (original) A method in accordance with claim 98 in which said noble gas fluoride is xenon difluoride and said non-etchant gaseous additive is a member selected from the group consisting of helium, neon, and mixtures one or more or helium and neon with one or more of nitrogen and argon.

103. (original) A method in accordance with claim 98 in which said noble gas fluoride is xenon difluoride and said non-etchant gaseous additive is a member selected from the group consisting of helium and a mixture of nitrogen and helium.

104. (original) A method in accordance with claim 84 in which said etchant gas is a halogen fluoride.

105. (original) A method in accordance with claim 104 in which said halogen fluoride is a member selected from the group consisting of chlorine trifluoride, bromine trifluoride, and iodine pentafluoride.

106. (original) A method in accordance with claim 104 in which said halogen fluoride is a member selected from the group consisting of chlorine trifluoride and bromine trifluoride.

107. (original) A method in accordance with claim 104 in which said halogen fluoride is bromine trifluoride.

108. (original) A method in accordance with claim 84 in which the partial pressure of said etchant gas is from about 0.3 mbar to about 30 mbar.

109. (original) A method in accordance with claim 84 in which the partial pressure of said etchant gas is from about 1 mbar to about 15 mbar.

110. (original) A method in accordance with claim 84 in which the partial pressure of said etchant gas is from about 1 mbar to about 15 mbar, and the mole ratio of said non-etchant gaseous additive to said etchant gas is from about 10:1 to about 200:1.

111. (original) A method in accordance with claim 110 in which the partial pressure of said etchant gas is from about 1 mbar to about 15 mbar, and the mole ratio of said non-etchant gaseous additive to said etchant gas is from about 20:1 to about 150:1.

112. (original) A method in accordance with claim 84, in which said non-silicon portion is a member selected form the group consisting of non-silicon metals and metal compounds.

113. (original) A method in accordance with claim 112 in which said non-silicon portion is a member selected from the group consisting of titanium, gold, tungsten, and compounds thereof.

114. (original) A method in accordance with claim 112 in which said non-silicon portion is gold.

115. (original) A method in accordance with claim 84 in which said silicon portion is a silicon layer deposited over a substrate and said non-silicon portion is a layer of a member selected from the group consisting of silicon nitride, silicon carbide, and silicon oxide deposited over said silicon layer, said non-silicon layer being patterned to leave vias therein for access of said gas mixture to said silicon layer, the exposure to said gas mixture being of sufficient duration to laterally etch away substantially all of said silicon layer by access through said vias.

116. (original) A method in accordance with claim 84 in which said silicon layer is a polysilicon layer deposited over a substrate and said non-silicon portion is a layer of silicon nitride, said silicon nitride layer being patterned to leave vias therein for access of said gas mixture to said polysilicon layer, said exposure to said gas mixture being of sufficient duration to laterally etch away substantially all of said polysilicon layer by access through said vias.

117. (original) A method in accordance with claim 116 in which said polysilicon layer is from about 200 nm to about 5000 nm in thickness.

118. (original) A method in accordance with claim 116 in which said polysilicon layer is from about 250 nm to about 3000 nm in thickness.

119. (original) A method in accordance with claim 116 in which said polysilicon layer is from about 300 nm to about 1000 nm in thickness.

120. (original) A method in accordance with claim 116 in which said silicon nitride layer is from about 10 nm to about 500 nm in thickness.

121. (original) A method in accordance with claim 116 in which said silicon nitride layer is from about 20 nm to about 200 nm in thickness.

122. (previously presented) A method for forming a micromechanical device, comprising:
depositing a silicon layer on a substrate;
doping the silicon layer during or after depositing the silicon layer;
depositing a micromechanical structural layer on the silicon layer;
releasing the micromechanical structural layer by removing the silicon layer by etching with a vapor phase etchant that comprises an interhalogen or a noble gas halide.

123. (original) The method of claim 122, wherein the dopant is borane, arsine or phosphine.

124. (original) The method of claim 41, wherein the etch rate is 10 um/hr or less.

125. (original) The method of claim 124, wherein the etch rate is 2 um/hr or less.

126. (original) The method of claim 125, wherein the etch rate is 1um/hr or less.

127. (original) The method of claim 122, wherein the silicon is deposited by chemical vapor deposition.

128. (original) The method of claim 127, wherein the silicon is deposited by PECVD.

129. (original) The method of claim 127, wherein the silicon is deposited by LPCVD.

130. (original) The method of claim 122, wherein the silicon is deposited by sputtering.

131. (original) The method of claim 122, wherein the dopant is PH3, P2H5, B2H5 or BCl3.

132. (original) The method of claim 122, wherein the dopant is a boron, phosphorous or arsenic dopant.

133. cancelled